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LEPIDOPTERA REARED IN MANITOBA FROM POISON IVY.*

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Among plants that possess toxic properties few are so well known, or so much dreaded, in North America, as poison ivy (*Rhus toxicodendron*). The plant is distasteful to nearly all herbivorous animals, though its berries are eaten by a few rodents and birds. On the whole it is permitted to flourish unmolested and it has managed to enlist the cooperation of several birds as aids in the distribution of its seeds. The immunity enjoyed by this plant from larger creatures does not, however, apply to the smaller forms of life and among its insect enemies Coleoptera, Diptera and Lepidoptera are represented. A study of the lepidopterous insects found feeding upon poison ivy was begun some years ago and a number of species were reared. The notes relating to these have now been brought together under the above heading.

Paectes oculatrix Guer.

The larvae of this species are found only on plants growing among trees where there is considerable shade. They do not curl the leaves but invariably rest on the undersides of them. These caterpillars have a characteristic method of eating irregular holes in the leaves as a result of which the edges become torn and ragged. The larvae are present throughout July and early August; pupation takes place in the ground, and the moths emerge in June of the following year. A description of a mature larva follows:—

Length 22 mm.; head much rounded, narrower than body, the latter widest at segment 5, decidedly narrowing posteriorly. Colour pale green, somewhat bluer beneath and on head. Head finely and densely granulate; body irregularly marked with white blotches of various shapes and sizes, all tending to have rounded edges. These spots may be separated by more than their width or may coalesce. There is a narrow, broken stigmatal line of dull white with a repetition of the irregular spots beneath it. Spiracles pale brown. Ventral surface without marks. Legs pale, claws brown; prolegs developed into flat projections at the tips giving them the appearance of an inverted T; crotchets dark. The posterior pair of prolegs, when the larva is at rest, project out behind, thus appearing to form a part of the body. Both the head and the body are provided with various fine hairs, those of the latter projecting from very small, inconspicuous tubercles.

The larvae are very similar throughout all their stages excepting that in the first instar the head exceeds the body in width and the white spots are absent. The larvae during the first instar are able to let themselves down by means of a silken thread; later they lose this habit. The strongly developed prolegs are obviously meant for grasping the leaves while the larvae are in an inverted position.

*—Contribution from the Division of Field Crop and Garden Insects, Entomological Branch
Dept. of Agric., Ottawa.

***Epipaschia zelleri* Grt.**

The larva of this species is rather strikingly colored and is found attacking poison ivy in open localities. Its presence may be detected by the leaves being curled lengthwise in such a way that they form tunnels, frequently continuing from leaf to leaf. These are traversed by the larvae, when disturbed, with great rapidity, thus enabling them to readily escape from their enemies. Only one larva lives in each tunnel but frequently the insects are so numerous that they infest every plant over an area of many square feet and under these conditions several may be found in close proximity. The larvae are present in July and August, they pupate in the ground and the moths emerge in late June or early July of the following year. The insect is the most destructive to poison ivy of any insect species so far studied. A description of a mature larva follows:—

Length 23 mm. Head light orange indistinctly marked with paler vermiform lines and coarse reticulation. Thoracic shield pale yellow, the mid-dorsal portion brownish, divided longitudinally by a light median line and bordered by a broken band of similar color; beyond this is a broad, dark stripe bordered anteriorly by white and posteriorly by a black line extending two thirds forward across the shield. Body pale yellow, separated into stripes by darker areas as follows: A dull median stripe, becoming narrower and paler posteriorly, a sub-lateral stripe of similar colour; and a broken irregular chestnut-colored lateral stripe narrowly separated from a very wide stripe of the same colour extending down the sides, with which it intermittently coalesces in the middle segments and unites completely on the posterior segments; below this wide band is a narrow irregular substigmatal stripe, and centering on the spiracles a bright yellow area bordered below on the thoracic segments by a broken chestnut-colored band. Under surface yellowish white; spiracles dark rimmed; legs brown on outer edge near tips; prolegs white; crotchets brown. The tubercles with one exception are small, those above being black, the lower ones pale; all bear a brownish colored bristle. The tubercle number 3 of segment 10 however is very large and is furnished with a stouter bristle.

***Episimus argutanus* Clem.**

This is one of several leaf curlers attacking poison ivy in August. It is to be met with in wooded situations and its work may be generally recognized by the leaves being curled upwards at their edges. A fully developed larva will curl approximately a third of a leaf.

The larvae vary much in colour, some individuals being pale olive-green, others pinkish. As a rule, however, there is a ground colour of dull green which is suffused with rose. Head semi-transparent, brownish; tubercles large, shining, darker than body, each with a pale bristle. Length 10 to 11 mm. The moths appear in late May or early in June.

***Cacoecia argyrospila* Walk.**

This well known fruit-tree pest apparently adds poison ivy to its food plants, moths reared from the plant having been determined as *argyrospila* by Dr. J. H. McDunnough. Larvae were found in some numbers curling the leaves of poison ivy in early June. They were pea-green in colour with a dark head and thoracic shield; tubercles rather conspicuous each provided with a long white

bristle; length 20 to 27 mm. There is a good deal of individual variation in colour both of the larvae and adults. The moths emerge towards the middle of June.

***Lithocolletis guttifinitella* Clem.**

The work of this well-known species is recognizable by the larval mines which turn white. The pattern formed on the leaves is very diversified and by no means devoid of beauty. One or several larvae may inhabit a single leaflet. As the season advances the small larvae form circular cysts in their tunnels in which they pupate emerging as moths the following spring. The species is an inhabitant of semi-open woods and its work is very conspicuous as the leaves begin to turn red in autumn.

***Gracilaria rhoifoliella* Cham.**

Only a single moth was reared but larvae which are taken to represent the species have been found mining, and afterwards curling the edges of leaves, the curled portion being held in place by many silken threads placed in bunches. Pupae were found enclosed in a lightly woven cocoon generally hidden in a leaf but occasionally in view. Larvae were present in July and the moths emerged in September.

A NEW CANADIAN MOSQUITO (CULICIDAE).*

BY ERIC HEARLE,
Indian Head, Sask.

The writer has had by him for some years a small series consisting of both sexes of an interesting mosquito taken on one of the small coastal islands near Victoria, British Columbia. Description has been postponed from time to time in the hope that further specimens, together with larvae, would indicate the status of this species in relation to another form occurring commonly in the mountains, and interior and northern parts of the province. Since there seems little chance of these being secured at present it is thought best to offer a name and describe the species at this time.

***Aedes pacificensis* new species.**

Female. Proboscis long, slender, uniform; vestiture black. Palpi short, less than one fifth the length of the proboscis; vestiture black, with occasionally a few white scales. Antennae black, tori dark with patch of white scales dorsally. Clypeus roundly triangular, nude, black. Eyes reddish black. Occiput black, clothed with narrow, curved, yellowish scales on vertex, with a few similarly shaped brown scales intermixed, broad flat yellowish white ones at side, a patch of broad black scales sub-laterally on each side, many short erect forked scales at nape, most of these dark; setae along margins of eyes black.

Prothoracic lobes black, clothed with curved yellowish scales and dark bristles. Mesonotum with black integument, clothed with narrow curved yellowish and brown scales, the darker ones predominating, giving fairly uniform dark grey effect; usually a few light scales grouped to form faint pair of discal spots; scales surrounding ante scutellar space creamy white; bristles dark. Scutellum trilobate, black, clothed with creamy white scales and black bristles. Postnotum black, pruinose. Pleura dark, clothed with broad creamy white scales and pale bristles.

*—Contribution from the Entomological Branch Dept. of Agric., Ottawa.

Abdomen clothed dorsally with brownish black scales and with broad, basal, segmental bands of creamy white scales, bands slightly widened at sides; setae pale; first sement with numerous broad white scales and pale setae; venter almost entirely pale scaled; cerci black.

Wings fairly heavily and coarsely scaled, scales gathered densely at base of third vein, distinct spot at cross vein. Number of small dark bristles along the costa among the broad spatulate scales; outstanding scales broadly linear; a number of broad pale scales grouped at the base of the costal vein and a few scattered along the costa, auxiliary and first veins; remainder brownish black; a few pale bristles near the base of the first vein at juncture with the fourth vein. Halteres whitish.

Legs dark, but with extensive scattering of pale scales; femora mainly white scaled except apical third above, extreme tip white scaled; tibiae with blackish brown and pale scales fairly evenly mixed; tarsi with many pale scales at basal end, but almost entirely dark scaled towards apex. Each claw with a strong tooth reaching to about middle.

Length: Body about 6.5 mm.; Wing 5.5 mm.

Male: Coloration much as in female but somewhat darker. Proboscis dark scaled. Palpi not quite as long as proboscis; end of long joint, and last two joints enlarged and with long dense black hairs; vestiture black, with only a few scattered white scales at middle of long joint; (a few specimens show fairly extensive patch of white scales). Antennae very heavily plumose; hairs of whorls long, dense and brownish black in color. Thorax with fairly extensive tuft of black hairs on each side, extending from prothoracic lobes to first coxa. Lateral abdominal cilia long, dense, pale. Claws with single tooth towards base.

Length: Body about 7 mm.; Wing 6 mm.

Genitalia: Side pieces about three times as long as wide; apical lobe fairly small, roundly prominent; with a few very delicate hairs outwardly directed; basal lobe prominent and fairly well developed, with numerous hairs and a strong marginal spine, adjacent hairs of the lobe somewhat shorter than this. Clasper long, swollen somewhat at middle and tapering towards apex; with long articulated terminal spine, and two to four very fine sub-terminal hairs on outer side. Claspette with fairly long, columnar base, strongly curved on apical half, basal two-thirds with much delicate short pile; filament of claspette fairly long, sickle shaped, broadly and smoothly expanded from base to basal quarter, and gradually tapering from here to tip, which is curved and fairly strongly chitinated. Tenth sternites heavily chitinated, each with short blunt hook at tip. Aedoeagus approximate forming a small basal cylinder. Lobes of ninth tergite approximate, rounded and bearing about seven short, stout spines.

Described from a series of eight males and six females taken by Mr. Walter B. Anderson on Discovery Island, British Columbia, April 12th, 1920.

Holotype—Male, Discovery Island, B. C., April 12th., 1920 (W. B. Anderson); No. 2501, in the Canadian National Collection, Ottawa.

Allotype—Female, same data.

Paratypes—7 males and 5 females, same data.

It will be seen from the above description that the species under consideration is closely allied to *Aedes cataphylla* Dyar—in fact the differences that can be demonstrated either in coloration or structure are very slight. In general *A. cataphylla* is somewhat smaller, female specimens from Alaska, and various parts of British Columbia and Alberta measuring about 5 mm. (body) and 4.5 mm. (wing). The pale scales are yellowish in comparison with the sordid white of *Aedes cataphylla*, and the wings are more coarsely scaled and veined. The distinct spots formed by the grouping of scales at the base of the third vein distinguish the specimens from Discovery Island from the many hundred *A. cataphylla* the writer has examined from various points in Alberta and British Columbia. Dr. Dyar who has kindly examined the Discovery Island material informs me that Californian *A. cataphylla* show a greater bunching of the scales than do specimens from the Rocky Mountains in Alberta, but that this is less marked than in the species under discussion. The closest relatives—*Aedes cataphylla* Dyar, *Aedes impiger* Walker and *Aedes niphadopsis* Dyar and Knab show no specific differences in the male genitalia, although the larva of each species is very characteristic. This being the case the question as to whether the form discussed in this paper can be considered as a distinct species or merely as a local race of *Aedes cataphylla* Dyar cannot definitely be settled until larvae are available. As the habitat is quite out of keeping with our knowledge of *cataphylla* it is advisable for the present to consider the species as being distinct. It is of interest to note that *Aedes niphadopsis* Dyar and Knab is a brackish water derivative of *Aedes cataphylla* and that a derivative of the closely allied *Aedes impiger* Walker is found in brackish water in Europe.

Mr. Walter B. Anderson of Victoria, who took the specimens has kindly supplied the writer with the following notes with regard to the habitat: "The island is not high—perhaps a hundred feet or so. Has dry wooded ridges and bare rocky ones, with an occasional small salt marsh near the shore. The place is sometimes swept by strong west winds. Males were dancing in a thick column on a thinly wooded ridge near a salt marsh."

THE GENUS CLASTOPTERA (CERCOPIDAE).

BY E. D. BALL,

Sanford, Florida.

The members of this genus are all small and globose and are easily separated from other Cercopidae, but here the easy part abruptly ends. The varieties are widely variable in size, form and color, ranging in most species from large pale forms through spotted, striped and variously ornamented ones on down through coppery and bronzy shades to small black forms at the other extreme. The representatives of this group are distributed through North and South America where some 68 or 70 different forms have been named. All of the earlier ones and most of those of later date have been founded on size and color markings alone, which vary with the sex, the food plant, the environment and in some cases at least with the season. Under the circumstances it is manifestly impossible to determine the number of species involved or to work out a stable nomenclature until extended collection and careful life history has been done in the areas involved.

The writer some thirty years ago made a serious attempt to work out the forms occurring in the United States and Canada. This was his maiden effort in systematic work and, as he was woefully ignorant of the laws of priority with reference to subspecific and varietal names, he made mistakes in nomenclature and in the interpretation of previous descriptions. All of the then available material in the different collections was assembled, carefully and thoroughly studied for structural or constant colorational differences, and it was found that the twenty or more forms could be definitely arranged in four structural types that could be separated irrespective of color. These groups were considered as representing four species. The adoption of Fitch's method of presentation involving named subspecies and lettered varieties proved to be cumbersome and inadequate, and was responsible for most of the nomenclatorial errors.

Since that time there have been a number of partial or complete revisions of the group as found in this area. Baker ('00) and later Van Duzee ('12 and '16) pointed out errors and made helpful corrections. Each one, however, insisted on the addition of two more specific types, but did not agree as to the two. Lallemant ('13) in the *Genera Insectorum* alphabetically lists 32 supposed species for North and South America and some 26 varieties or synonyms. His treatment of the North American species both as to nomenclature and relationship is a hopeless muddle and not worth while attempting to correct. Ball ('20) added a number of varieties and McAtee ('20) gave a very helpful list and summary of the forms around Washington with further new varieties and corrections of the nomenclature. Stearns ('23) published in the *Hemiptera of Connecticut* an old manuscript on the *Cercopidae* without revision or inclusion of later additions. In the *Clastoptera* he followed the Van Duzee Catalog, errors and all, except in two instances and in both these cases the Catalog was correct as it stood.

Since his first revision the writer has collected in all of the major faunal regions north of Mexico and made extensive studies of life histories and food plants. On reviewing this material he is more than ever convinced that the large number of almost infinitely variable color forms are grouped, in our fauna, around four very definite structural units. Some of these units may possibly be further divisible, if so, these divisions should also present good structural characters or certain definite and unchanging color characteristics or both. Two or three times during the course of the years, the writer has become convinced that some one form or other was distinct only to find later that additional material from some other locality or season so thoroughly intergraded as to make it exceedingly doubtful. In general the fewer the specimens, the easier it is to believe that a distinct species exists. The four species occurring north of Mexico may be set off as follows:

- A. Front, inflated and abruptly elevated from face. Outer discoid cell equal or larger than inner. Second apical cell wider than long. Callosity round, located on the nervure and not reaching the posterior margin.
- B. Front, in outline a regular curve, pale with transverse bands above or all black. Light forms with 5-7 transverse black bands on disc of pronotum, bulla large. (arid west) *l. lineatocollis* Stal.
- BB. Front, in outline almost angularly produced with a broad shining black band crossing the produced part, below this bright yellow. Disc of

- pronotum solid black or yellow or rarely yellow with one dark band, bulla small. (humid east and south) 2. *proteus* Fitch.
- AA. Front, much less inflated rising gradually from face. Outer discoid cell smaller than the inner. Second apical cell about equal or longer than wide. Callosity (thickened area but not necessarily the colored area) spread over first apical cell.
- B. Small globose with a conical head, of a uniform color above (in our territory). Face pale with a median transverse black band and narrow arcs above. Second apical cell about square 3. *xanthocephala* Germ.
- BB. Larger, inclined to be elongate with the costal margins parallel, transversely banded anteriorly and saddle-marked or unicolorous with the face pale. Second apical cell elongate 4. *obtusa* Say.

1. *Clastoptera lineatocollis* Stal.

This is one of the most variable species in the genus in both size and color. The large striped and showy variety *delicata* females and the little black *lineatocollis* males are nearly the extremes in the group but the intergradation between the different varieties is so complete that there seems to be no question of specific identity. All the forms except *delicata* have almost indistinguishable black males and it may be that some of the black forms really belong to this variety as they have been taken commonly on the same plants. Baker ('19) pointed out that *lineatocollis* Stal was the proper name for this species and that *delicata* Uhl. would replace *lineata* Ball, but neither Van Duzee nor Stearns adopted these changes.

C. lineatocollis var. *delicata* Uhl.

Clastoptera delicata Uhl. Bul. U.S. Geol. Geogr. Sur. 1, p. 348-'76.

Clastoptera delicata sub. sp. *lineata* Ball. Proc. Ia. Acad. of Sci. 111, p. 148-'95.

Females large and light with narrow black bands and markings in sharp contrast, while the males are much smaller and darker.

This variety occurs from Central Colorado to Southern California and southward. The writer found the frothy masses of this variety abundant on the "Rabbit Brush" (*Chrysothamnus graveolans*) in sheltered locations in Colorado and to a less extent on the Sage Brush in the western areas.

C. lineatocollis var. *brunnea* Ball.

Small, bronzy, with markings somewhat reduced except for the shining black face. The females are about the size and color of the males of var. *delicata* while the males are small and black like the males of var. *binotata*.

The writer has taken this form commonly on Sage Brush (*Artemisia tridentata*) and in smaller numbers from Rabbit Brush on the "Western Slope" of Colorado, throughout Utah and a few examples were taken in the Bad Lands of North Dakota. Dr. J. McDunnough reports this form from Lillooet, B. C., on sage-brush.

C. lineatocollis var. *lineatocollis* Stal.

Smoky brown with heavy black bands alternating with light on pronotum and face. Males similar to those of *binotata*. This variety is somewhat larger than *brunnea* and intermediate in size between the larger forms of *delicata* and the small *binotata*. It superficially resembles varieties *tristis* and *borealis* of *C. obtusa*.

This variety has been taken by the writer abundantly on Sage Brush and Mint in California and occasional examples in Utah.

C. lineatocollis var. *lugubris* Ball.

Dark smoky brown with faint markings and a black or nearly black face. Known only from Southern California.

C. lineatocollis var. *binotata* Ball.

Females dull black with narrow light arcs on the front, a small light spot on costa and a larger light area in front of, and sometimes surrounding, the bulla. The males are much smaller and have the face all black and may lack the light markings along costa.

Occurs from the Rocky Mountains in Colorado west to California and southward. Common on the Sage Brush.

2. *Clastoptera proteus* Fitch.

The writer correctly interpreted the major variations of this species in his revision but the names used were certainly most unfortunate. That it was not an easy problem may be inferred from the fact that after five revisions the major errors are still to be corrected. This species has been taken on a considerable number of plants. Fitch describes it as abundant on dogwood (*Cornus paniculata*). The writer found it in abundance on a dogwood growing in a swamp near Toronto, Ont., and again at Kingston. He has taken it in Iowa on willow far from any dogwood. Miss Doering reports *C. salicis* which is probably a variety as found on willow in Kansas. McAtee found variety *hyperici* on St. Johns wort (*Hypericum prolificum*).

This species is common throughout the Northeastern States and Eastern Canada extending west to Montana and Northern Utah where it is rare. The writer has not taken it in Colorado or California where much collecting has been done; rather indicating that it will not be found in the arid southwestern region outside of the higher mountains. It extends south to Florida and Texas where it is again rare probably owing to the hot summer. Forms from Hayti and Mexico seem to be varieties of this species.

In several of the light varieties, males are rare or unknown and it is probable that in this species, as in *lineatocollis* the males of a number of the paler forms will be found to resemble the darker ones.

C. proteus var. *proteus* Fitch.

All yellow except a broad band across the front and a narrow one on anterior margin of vertex, sometimes another on the anterior margin of pronotum, together with the bulla shining black.

Fitch's description is incomplete as he does not mention the color of the pronotum, scutellum or elytra and the writer inferred that he was describing the common form, with the black and yellow areas on these parts in sharp contrast and in this all subsequent revisers have apparently concurred. Imagine, therefore, the surprise to find the type of *proteus* a pure yellow with only the narrow band on vertex and the bulla black. Fitch described *all the black* there was, and simply failed to mention the yellow parts. The writer suggested that all Fitch's subspecies belonged to the yellow group and in that he was correct but he did not expect to find the species itself to be the yellowest of all. Fitch's

subspecies were discarded, partly because the writer did not know that the rules gave them the same status as species names and partly because at that time the types were supposed to be lost and it was thought impossible to tell what they were, as only one color character was given. On studying the types, which are well preserved, it was found that the one color character given is all they have in addition to that given for the species. And what was given for the species was all it had so the combination makes a complete description in each case.

Fitch's subspecies all belong to the yellow group which was included under *flava* and will hereafter be known as *proteus* but as they, in their variations at least, represent different lesser types they may be retained by those who wish to subdivide to that extent as follows:

C. proteus var. *cincticollis* Fitch.

Yellow with a black band crossing the disc of the pronotum in addition to one or two narrow ones between the eyes.

Fitch's variety *a* and *b* of *cincticollis*, with the narrow anterior band on pronotum as well as vertex, are the normal type of the species and should be included in variety *proteus* as has been done above. Varieties *c* and *d* as described above, are definite steps towards the black marked forms and may be retained with this name.

C. proteus var. *maculicollis* Fitch.

Yellow with the one or two anterior bands between the eyes and one or two larger spots on disc of pronotum black.

C. proteus var. *flavicollis* Fitch.

Yellow with one or two bands between the eyes and an oblique band on clavus black.

Var. *a* of this subspecies is exactly the same as the var. *proteus*. Apparently Fitch did not follow the rule that the typical subspecies or variety should bear the name of the species. Var. *b*, however, introduces the first variation towards the *vittata* type and may be worth recognizing as above.

C. proteus var. *saint-cyri* Prov.

Clastoptera saint-cyri Prov. Le Naturaliste Canadien 4-p. 351-1872.

C. proteus sub. sp. *vittata* Ball. Proc. Ia. Acad. Sc. 111, p. 187-1895.

Normal yellow and black bands on face, vertex and anterior half of pronotum. Posterior half of pronotum and scutellum black or variable, clavus obliquely striped with yellow and black, disc of corium black or smoky divided by a yellow ray.

The writer had not seen the original description of *saint-cyri* and was misled into referring it to sub. sp. *flava* by the examination of a specimen supposed to be from Provancher. The original description is good and leaves no doubt as to its very distinct characters.

C. proteus var. *salicis* Doering.

Clastoptera salicis Doering. Ann. Ent. Soc. Am. 19, p. 85 fig. 1926.

Resembles *saint-cyri* but with the posterior part of pronotum irregularly yellow and black and the costal dash reduced to a spot. This was described as a distinct species based largely on size and a slight difference in color and internal genitalia. Size in this group is very variable and the fact that only three males were taken with seventy females suggest that this is another color variation of

the *proteus* females in which only an occasional male occurs. Further examples may show intergradation into typical *saint-cyri*.

C. proteus var. *seminuda* n. var.

Yellow with the black bands on face, vertex and anterior margin of pronotum. Pronotum and scutellum yellow very narrowly edged with black, clavus bright yellow, corium yellow at base, smoky subhyaline with a medium black cloud and a black bulla.

Holotype female and two paratype females Ames, Iowa, three paratypes Toronto, Ont. all collected by the author between June 22nd and August 8th. Two examples from Kingston, Ont. and one from Kansas show the darkening of the pronotum that grades towards the next variety.

C. proteus var. *flava* Ball.

C. proteus sub. sp. *flava* Ball. Proc. Ia. Acad. Sc. 111, p. 187 and 192-'95.

C. proteus var. *proteus* Van Duz. Cat. p. 519-'16. (not Fitch).

C. proteus var. *saint-cyri* Stearns. Hemip. Conn. p. 234-'23. (not Prov.).

Black with yellow bands on front, vertex and anterior part of pronotum. Sometimes a yellow spot on scutellum. Anterior two-thirds of clavus bright yellow, remainder of elytra black or smoky with a soiled yellow area at base and a pale area around the bulla sometimes extending clear across membrane. Males smaller and darker than the females with the yellow on clavus abbreviated.

The writer set off the common black and yellow form as sub. sp. *flava* and so described and distributed it. On page 192 var. *flava* is referred to as the common form throughout the upper Mississippi valley again showing that it was the black and yellow form that was in mind. All yellow forms normally would have to fall into that subspecies and in later distribution yellow forms were sent out as var. *flava*. Still later the common black and yellow form was referred to and distributed as var. *proteus*. Now that the study of the types and descriptions has shown that *proteus* is a yellow form and *saint-cyri* the oblique banded one, *flava* is the only name that remains for the black and yellow one.

This is the only form in which the sexes appear to be fairly equal. In all the lighter forms the females predominate in collections and in the darker forms the reverse is true, suggesting that when careful study is made that dark males will be found to be normal in most of the lighter varieties.

C. proteus var. *candens* McAtee.

Similar to *flava* except that all yellow markings are in form changed to red. Known only from Virginia.

C. proteus var. *osceola* n. var.

All black above except the three anterior yellow bands, a spot on scutellum, a yellow area at the base of elytron and a light area before the bulla. In the darkest example only the two anterior yellow bands remain.

Holotype—♀, Toronto, August 8-24.

Allotype—♂, Kingston, August 5-24.

Paratypes—3 pairs from the same localities and Osceola, Wis., all collected by the author.

C. proteus var. *anceps* McAtee.

Black with the lower part of face, yellow, an area at base of elytra, another before bulla and the membrane pale yellow or hyaline. Known from Maryland and New York.

C. proteus var. *hyperici* McAtee (Gib.).

C. proteus var. *hyperici* McA. Proc. Biol. Soc. Wash. 33, p. 174-1920.

C. proteus sub. sp. *nigra* Ball. Proc. Ia. Acad. Sc. 111, p. 187-1895 (Preoccupied).

C. proteus var. *pini* Van D. Cat. p. 520-1916 (not Fitch).

Black above with the lower part of the face bright yellow as usual. The writer has taken this form in the swamps of Northern Wisconsin and near a swamp at Woods Hole. Van Duzee reports it from around Lake Erie and McAtee along the lower Potomac. Apparently it is a lover of damp and shady situations.

3. *Clasptoptera xanthocephala* Germ.

This small southern form is very constant in size and color in our area and can be easily recognized from the other black or smoky forms in its range by the transverse bands on the upper part of the front. The bulla is set well back against the nervure as in *obtusa* var. *pini* but that form is larger and has a yellow face and yellow bands anteriorly.

This species ranges from New Jersey to Iowa (where it is rare) south to Florida, Mississippi and Texas, and on to Mexico at least. The writer has found the frothy masses of this species on many different plants in Florida ranging from shrubs and trees to grass, but its favorite hosts appear to be *Ambrosia* and *Helianthus*. There appears to be two generations a year in Florida. The fall and winter generation is largely of the *glauca* type while the summer generation comes out a brilliant shining black *xanthocephala* form.

C. xanthocephala var. *xanthocephala* Germ.

Black, shining, often with a reddish cast to vertex and upper part of front and a white spot on either costa. The face is barred above and pale below, separated by a narrow black band.

C. xanthocephala var. *unicolor* Fowl.

Clasptoptera unicolor Fowl. Biol. Cent. Am. Homop. 11, p. 205-1898.

C. xanthocephala var. *glauca* Heid. Proc. Ent. Soc. Wash. IV, p. 399 fig. 1901.

C. xanthocephala var. *glauca* Van D. Bul. Buf. Soc. N.S. X, p. 508-1912.

Face and below as in *xanthocephala*, above pale, glaucous, with subhyaline elytra. Frequently tinged with testaceous on head and occasionally on elytra.

The writer accepts Heidmann as the original author of the variety *glauca*, as pointed out by McAtee, but finds that *unicolor* of Fowler is still older and undoubtedly the same thing by description and typical examples from Mexico. Fowler refers to Fitch's manuscript species from Arkansas where this form is common.

4. *Clasptoptera obtusa* Say.

This is the most widely distributed species in the genus, occurring from the Atlantic to the Pacific and from Canada to the West Indies and Mexico and on to central South America at least. It has a wide range of host plants and presents well marked color variations on a number of them. The most stable varieties represented north of the Mexican border are as follows:

C. obtusa var. *testacea* Fitch.

Clasptoptera osborni G & B. Hemp. Colo. p. 70-'95.

C. obtusa sub sp. *osborni* Ball. Proc. Ia. Acad. Sc. 111, p. 190-'95.

Elongate, elytral margins nearly parallel. Testaceous, inclined to be rufous on vertex and scutellum; face testaceous. Bulla elongate, usually dark marked.

This variety has been taken by the writer on the jack pine in Wisconsin and on *P. Virginiana* in Maryland and Virginia. The type is somewhat faded but well preserved and unmistakable. Fitch's farm home in the Adirondacks was an ideal location in which to get this species and he reports it as found on oaks and pines. It has been taken in Ohio, West Virginia, New Jersey and North Carolina all within the eastern oak and pine areas. *C. osborni* G. & B. was described as from oak in Colorado and Van Duzee ('03) reports it (as *obtusa*) taken from pine in the same state. The writer has taken both larvae and adult from oaks in Colorado and has examples from Arizona and Mexico, and it has been reported from New Mexico. The Colorado and Arizona examples lack the black on the bulla, but the Mexican example has it. Baker insists that *osborni* is a distinct species from *obtusa* and gives differences in the number of pronotal wrinkles and shape of clavus neither one of which appear to be constant. Van Duzee and Sterns follow Baker but like him they were not acquainted with var. *testacea*. If this is a distinct species it will still be *testacea* of Fitch and not *osborni* G. & B. Stearns separates *osborni* from all others by the narrow elytra, ignoring the fact that the Colorado forms of typical *obtusa* and all mountain and northern examples of *testacea* have the character equally marked. The only character that is at all constant that the writer finds to separate *osborni* from *testacea* is the lack of black on the bulla and that appears too trivial to warrant even a varietal status. The writer was in error in calling this subspecies *osborni* as *testacea* has priority, he also erred in including *pini* which is sufficiently distinct to warrant a separate status.

C. obtusa var. *juniperina* Ball.

Small, pale testaceous with the dark apical cross nervures forming a half circle resting on the bulla. An oblique black line from the middle of the costa.

This is a clear cut and very distinct variety and would be considered as a species if it were not for a few variable forms and its evident relation to the next variety which is intermediate between this and typical *obtusa*. It occurs on the red cedar where its color and pattern closely resemble the strobile of this tree.

It has been taken by the writer, abundantly in Colorado and Utah and rarely in Montana, the Bad Lands of North Dakota, West Virginia, Washington, D. C. and Woods Hole, Mass.

C. obtusa var. *arborina* n. var.

Size and form of *juniperina* with its testaceous color and black markings. The elytra are washed with smoky with a definite white band running obliquely from the scutellum to the apex of the black line and down it to costa. Smaller than *obtusa* with the three transverse reddish brown bands on vertex and pronotum.

Holotype female, allotype male and two paratypes females taken by the author on white cedar at Muscatine, Iowa.

C. obtusa var. *pallida* Ball.

Pale testaceous with faint *obtusa* pattern in pale tawny. This form has been

taken on basswood and willow in Iowa, Wisconsin and D. C. along with typical *obtusa*.

C. obtusa var. *obtusa* Say.

Pale reddish brown shading to smoky on elytra with the oblique light saddle indicated but rarely emphasized except along the costa. Anterior half of pronotum and vertex pale with three reddish bands, face with narrow lines above and a medium dark band.

Say described this species for Council Bluffs, Ia. where it occurs on alder, basswood and willow. His description indicates the paler markings of the most common pattern of the species that occurs throughout its ranges.

C. obtusa var. *borealis* Ball.

Size and pattern of *obtusa* but much darker with the oblique light saddle emphasized in sharp contrast.

The writer took nymphs and what appeared to be immatures colored males of this form in abundance on the beaked Hazel Brush in shaded areas at Woods Hole, Mass. on July 11, '25. He has taken this form on alder in the Rocky Mountains, on basswood in Iowa and on grape in a Florida swamp. It seems to be found most abundantly in damp and shaded situations from Nova Scotia to the Pacific and south to West Virginia in the Appalachians and Colorado in the Rockies.

C. obtusa var. *tristis* Van. D.

Almost uniformly dark brown, back of the pale yellow anterior pronotal band.

This form has been taken by the writer on alder at Ames, Ia., at Kingston, Ontario, in the mountains of Colorado, on the slopes of Mt. Shasta, California and on wild grape in the dense swamps of Florida.

C. obtusa var. *achatina* Germ.

Anterior half of body bright tawny yellow, posterior half dark smoky brown in sharp contrast.

This rare form was described from Penna. and has been examined from N.Y., Mass. and Mo. and occurs in Mexico. This form was correctly determined and described in the original study. Later determinations included examples of what Van Duzee has since described as *tristis*.

C. obtusa var. *pini* Fitch.

Small, elongate, black with a narrow band on vertex and a broader one just back of pronotal margin, creamy, costal margin broadly creamy before the middle then narrowly white extending around bulla, face and all below pale yellow.

Fitch says found chiefly on pine at Salem, N.Y. The author beat three males and a female of this rare form along with examples of var. *testacea* from *Pinus virginiana* at Chevy Chase, Md., July 11, '20.

Examples have also been examined from New Jersey and North Carolina. Van Duzee apparently never differentiated this form as he insisted that *pini* Fitch was the black form of *proteus* and so lists it in his Catalog. The writer had the two forms in hand and correctly separated and described in his original paper. Since then he has twice studied the Fitch types at Albany and

found the types of *pini* faded to brown but showing the *obtusa* type of venation and location of bulla. The almost flat, yellow face alone will distinguish the two, as all varieties of *proteus* have a broad shining black band on the inflated face. McAtee reports this form from Maryland and considers it a distinct species. The writer has several times thought he had found distinct species in this group only to have more material show wider variation and shake his faith. Varieties *testacea* and *juniperina* as taken in the Rocky Mountains are strikingly distinct but when eastern and southern forms are studied intermediate forms appear.

REVIEW OF THE CANADIAN SPECIES OF THE DIPTEROUS FAMILY BLEPHARICERIDAE.*

BY G. S. WALLEY,

Ottawa, Ont.

The present paper is an attempt to review and bring up to date our knowledge of the Canadian species of net-winged Midges or Blephariceridae. Since the publication in 1903 of Kellogg's "Net-Winged Midges of North America," several new species have been added to our list and additional records have come to hand thus increasing our knowledge of the distribution of several species; also certain generic changes seem advisable and it is hoped that the present paper will serve to facilitate the identification of our Canadian species.

In order to make the paper as complete as possible the keys have been formulated to include all the described North American species. This has seemed advisable because of the wide distribution which certain species have and while at present they may not be recorded from Canada, it seems very probable that they form a part of our fauna.

Of the six species known to occur in Canada, four have been taken exclusively in the mountainous regions of Alberta and British Columbia; one species, *Blepharicera tenuipes* Walk., has been taken only in the east and *Agathon canadensis* Garrett, described from British Columbia, is recorded from Ontario only by a single female which, if it did not agree so perfectly with Garrett's type material, might be regarded as a misidentification.

TABLE OF GENERA OF NORTH AMERICAN BLEPHARICERIDAE

1. No incomplete vein (M₃) between the fourth and fifth longitudinal veins *Paltosoma* Schiner (Mexico).
An incomplete vein (M₃) between the fourth and fifth longitudinal veins 2.
2. Pleura pilose *Bibiocephala* O. S.
Pleura bare 3.
3. Posterior basal cell present, i.e. M₄ and M₅ connected by a cross-vein 4.
Posterior basal cell absent, i.e. no cross-vein connecting M₄ and M₅ *Blepharicera* Macq.
4. Second longitudinal vein unbranched *Philorus* Kell.
Second longitudinal vein branched; the branch varying in length, sometimes very short simulating a cross-vein near base of second vein
..... *Agathon* von Röder.

*—Contribution from the Division of Systematic Entomology, Entomological Branch, Dept. of Agric., Ottawa.

Blepharicera Macquart.**Blepharocera Authors**

Members of this genus are distinguishable from other North American genera in that they possess an incomplete M₃ vein, the pleura are bare and there is no posterior basal cell present in the wing.

TABLE OF SPECIES

1. Eyes in female contiguous, in male broadly separated *osten-sackeni* Kell.
Eyes in both sexes narrowly separated 2.
2. Ungues rather long and slender *tenuipes* Walk.
Ungues short and stout *jordani* Kell.

Blepharicera osten-sackeni Kellogg.

Blepharocera osten sackeni, Kellogg. Proc. Cal. Acad. Sc. (3), Zool. Vol. 3, p. 191, pls. 1903.
Described from several specimens of both sexes, all from northern California. There are no other records for this species.

Blepharicera jordani Kellogg.

Blepharocera jordani, Kellogg. Proc. Cal. Acad. Sc. (3), Zool. Vol. 3, p. 189, pls. 1903.
Known only from the type locality, California.

Blepharicera tenuipes Walker.

Asyndulum tenuipes, Walker. List Dipt. Brit. Mus. Vol. I, p. 86, 1848.
Blepharocera tenuipes, Loew. Berl. Ent. Zeitschr. Vol. VII, p. 298, 1863.

This species is found widely distributed over eastern North America. Kellogg gives an account of the life history and structure of this form (Ent. News, XI, p. 305, 1900).

The species is found quite commonly in the Ottawa region and the following localities are represented by specimens in the Canadian National Collection: Wakefield, Que. June 14—July 28; Ottawa Golf Club, Que. July 14; Hull, Que. June 26; Laprairie, Que. July 8; Covey Hill, Que. June 17.

Kellogg's key (Proc. Cal. Acad. Sc. (3), Vol. 3, p. 200, 1903) states for this species "length not less than 7 mm." Among my Wakefield specimens there are two sizes, the smaller specimens measuring scarcely 4 mm. in length. Beyond the fact that the females of these smaller forms are slightly paler in color there seems to be no difference and the structural characters in both sexes agree with those of *B. tenuipes*. It is possible that two species may be involved but until a study of the immature stages is made I refer them all to the one species, merely pointing out the size and color differences.

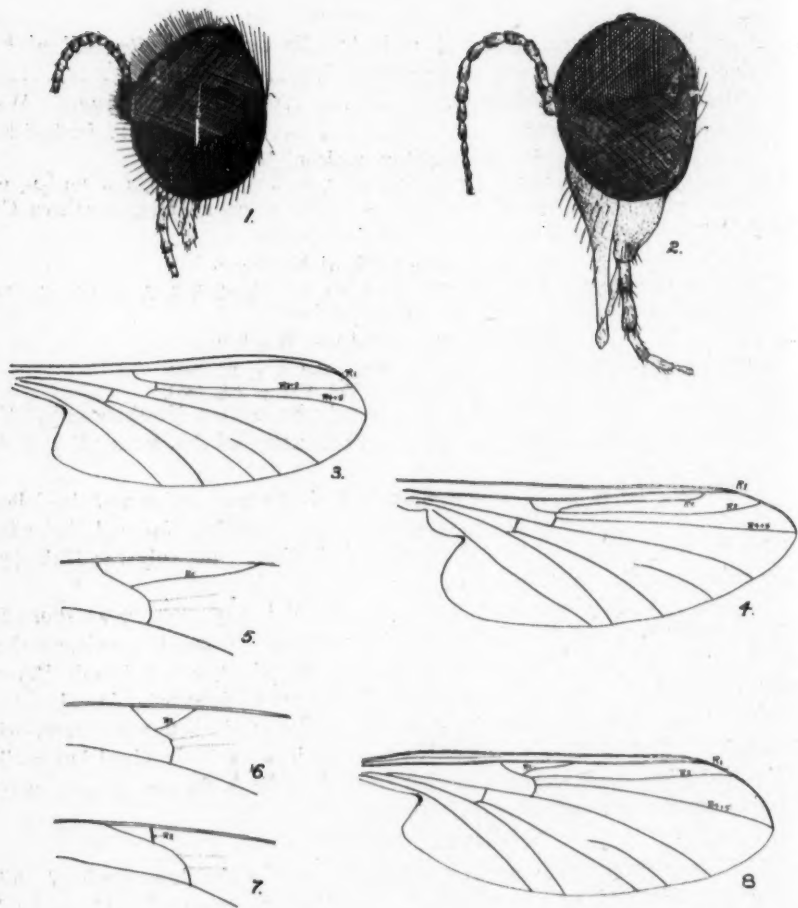
Philorus Kellogg.

Kellogg proposes the generic name *Philorus* for the three species *L. bilobata* Loew, *Blepharicera yosemite* O.S. and *Blepharicera ancilla* O.S. when he places the type species *Liponeura cinerascens* Loew, under *Blepharicera*.

The characters distinguishing the genus are as follows: an incomplete vein near the posterior margin of the wing between M₄ and M₅; the second longitudinal vein simple, unbranched; fourth and fifth longitudinal veins connected by a cross-vein.

TABLE OF SPECIES

1. R₂+3 and R₄+5 fused only at base 3.
R₂+3 and R₄+5 united to form a single vein for a distance equal to length of R₄+5 beyond point of separation 2.
2. Eyes separated by moderately broad front *yosemite* O.S.



CANADIAN SPECIES OF BLEPHARICERIDAE

1. *Bibiocephala griseus* ♂. 2. *Agathon canadensis* ♀. 3. *Philorus aylmeri*. 4. *Bibiocephala griseus*. 5. *Agathon canadensis*. 6. *Agathon elegantula*. 7. *Agathon doanei*. 8. *Agathon canadensis*.

- Eyes contiguous in front *ancilla* O.S.
 3. R2+3 and R4+5 divergent at tips; Cu1 arising from MCu cross-vein
 *aylmeri* Garrett.
 R2+3 and R4+5 not divergent at tips; Cu1 arising slightly before MCu
 cross vein (Europe) *bilobata* Loew.

***Philorus yosemite* Osten-Sacken.**

Blepharocera yosemite, Osten-Sacken. Bull. U.S. Geol. Survey, Vol. 3, p. 195, 1877.

Known only from the type locality, Yosemite Valley, California.

***Philorus ancilla* Osten-Sacken.**

Blepharocera ancilla, Osten-Sacken. Cat. N. Amer. Dipt. (2 ed.), p. 266, 1878.

This species is very closely related to the preceding. The contiguity of the eyes has not proven a very satisfactory character for separation but from descriptions alone it seems the only one available. Since the descriptions of these two species are markedly similar and are based on opposite sexes it seems possible that only one species is involved.

The type locality is California.

***Philorus aylmeri* Garrett.**

Fig. 3.

Philorus aylmeri, Garrett, Can. Ent. LV, 244, 1923.

This species, the only Canadian representative of the genus is known only by the single male type specimen taken at Aylmer Creek Falls, Lake Minnewanka, Banff, Alberta, August 30.

***Bibiocephala* Osten-Sacken.**

This genus is at once distinguishable from all other North American genera by the pilose pleura. Three Canadian forms and a Californian one belong to this genus.

TABLE OF SPECIES

- | | |
|---|---------------------|
| 1. Upper section of compound eyes with both long and short hairs | 2. |
| Upper section of compound eyes with only short hairs | 3. |
| 2. Eyes of male contiguous; front femora and basi-tarsi normal <i>griseus</i> Curran. | |
| Eyes of male narrowly separated; front femora and basi-tarsi incrassate | |
| <i>kelloggi</i> Garrett. | |
| 3. Eyes contiguous; front femora of male distinctly curved | <i>grandis</i> O.S. |
| Eyes separated by a narrow space in both sexes; front femora of male straight | |
| <i>comstocki</i> Kellogg | |

***Bibiocephala griseus* Curran.**

Figs. 1, 4.

Bibionus griseus, Curran, Can. Ent. 55, 268, 1923.

This species was known only by a single male collected at Nordegg, Alberta in 1923. Recently however a female from Maligne Lake, Jasper Park, Alta. has come to hand which is undoubtedly *griseus*. In both sexes the compound eyes bear long hairs. The female differs only sexually from the characters given in Curran's description of the male.

***Bibiocephala grandis* Osten-Sacken.**

Bibiocephala grandis, Osten-Sacken, Geol. Surv. of the Terr. for 1873, p. 566, 1874.

Recorded from Colorado, New Mexico, Utah and Idaho. A single female specimen from Seton Lake, Lillooet, B.C., May 31, is the only record for Canada.

Bibiocephala kelloggi Garrett.*Bibiocephala kelloggi*, Garrett, Insec. Ins. Menst. Vol. 10, p. 91, 1922.

Known only by the single male type specimen collected in 1921 at Cranbrook, B. C.

Bibiocephala comstocki Kellogg.*Bibiocephala comstocki*, Kellogg, Proc. Calif. Acad. Sc. (3), Vol. 3, p. 192, pls. 1903.

Known only from California.

Agathon von Röder.

The species belonging to this genus have the pleura bare, the posterior basal cell present and the second longitudinal vein branched.

TABLE OF SPECIES

1. Eyes of both male and female bisected 2.
Eyes of male only, bisected; second branch of Radius very short simulating a crossvein and forming a triangle in which R₂ is shortest side *doanei* Kell.
2. Second branch of Radius almost as short as in *doanei* but in triangle formed R₂ is not the shortest side *elegantula* von Röder.
Second branch of Radius distinctly longer than in *elegantula* and *doanei*, not simulating a crossvein *canadensis* Garrett.

Agathon doanei Kellogg.

Fig. 7.

Liponeura doanei, Kellogg, Psyche, Vol. 9, p. 39, 1900.*Bibiocephala doanei*, Kellogg, Proc. Calif. Acad. Sc. (3), Zool. Vol. 3, p. 194, pls. 1903.

Known only from California. Both sexes have been described.

Agathon elegantula von Röder.

Fig. 6.

Agathon elegantula, von Roder, Wien. Ent. Zeit. 10, 230, 1900.*Bibiocephala elegantulus*, Kellogg, Proc. Calif. Acad. Sci. (3), Zool. Vol. 3, p. 193, pls. 1903.

Recorded from Nevada, Idaho and Colorado. Both sexes have been taken.

Agathon canadensis Garrett.

Figs. 2, 5, 8.

Bibiocephala canadensis, Garrett, Insec. Ins. Menst. Vol. 10, p. 89, 1922.

This species has been recorded only from Canada. The following localities are represented: Wilson Creek, B.C. (5000 ft. elevation) Aug. 26 to Sept. 18, both sexes; Cheakamus, B. C. June 23, two female specimens; Ottawa, Ont. June 16, one female specimen.

NOTES ON THE SPECIES OF THE GENUS *HEXAGENIA* WITH DESCRIPTION OF A NEW SPECIES (EPHEMEROPTERA).*

BY J. MCDUNNOUGH,

Ottawa, Ont.

In a pamphlet entitled "Burrowing Mayflies of Our Larger Lakes and Streams," published in 1920 in the Bulletin United States Bureau of Fisheries, Vol. XXXVI, pp. 269-292, Professor Needham, discussing the species of the genus *Hexagenia*, makes the statement (op. cit. p. 279) that he is "unable to recognize more than two good and distinct species in the Eastern United States—a lowland species from lakes and rivers, *Hexagenia bilineata* Say. and an upland bog-stream species, *H. recurvata* Morg." He amplifies this statement in previous paragraphs (p. 278) by applying the name *bilineata* Say. "to all the variants of

*—Contribution from the Division of Systematic Entomology, Entomological Branch, Dept. of Agric., Ottawa.

the species that occupies the beds of our larger lakes and streams. The color differences appear to be only differences of degree. Even the differences of male genitalia—usually our ultimate criteria of species—are intergradient."

With the above conclusions I must most emphatically disagree; from a study of a large number of dried specimens and further from personal observations on living material (both subimagos and imagos) during the annual "swarming" period at Sparrow Lake, Ont., in the latter half of June, 1925, I am convinced that there are a number of good species in this genus, closely related, it is true, but well separable, partially on male genital characters and also on color pattern of the abdomen, size of eyes, etc.; none of these features varies to any appreciable extent in any given species and Needham's so-called intergradients are in reality good species.

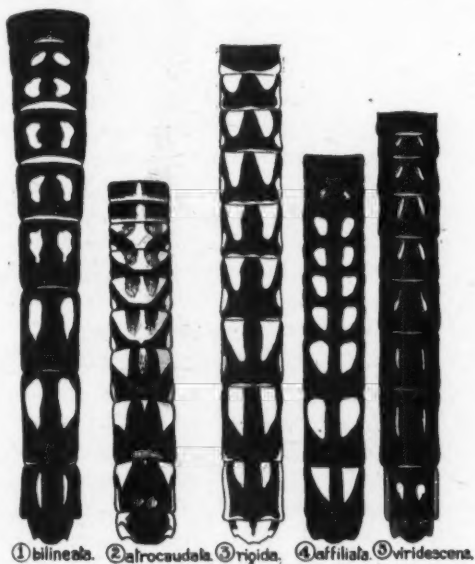


Fig. 1. Abdominal Pattern of Canadian Hexagenias.

The correct identity of *bilineata* Say has been ably established by Dr. Ulmer in 1921 (Archiv. f. Naturg. 87, Abt. A, pp. 233-9); Walsh's identification of Say's species has been confirmed and figures showing the distinctions between *bilineata* Say and *limbata* Guer., both in abdominal maculation (vide fig. 1) and in male genitalia, are given. I commented on this article in the Canadian Entomologist, 1924, p. 90 and might now add that fresh material from Rock Island, Illinois, received through the kindness of Dr. T. Frison of the Illinois State Natural History Survey has only served to strengthen my opinion as to the correctness of Ulmer's identification. In his original description Say mentions "posterior edges of the segments white above," a feature quite noticeable in these specimens and to my knowledge not nearly so evident in any other species. *Bilineata* seems confined to the Mississippi river and its tributaries and has not yet been captured in Canada. Needham's figure (op. cit. Pl. LXXXI, 62), to which

he has applied the name *bilineata* form *falcata*, represents the genitalia of typical *bilineata*, and *falcata* Needham will therefore fall as a direct synonym of Say's species.

In 1924 (Canadian Entomologist, LVI, pp. 90-93) I described two further species in the genus as *rigida* and *atrocaudata*, based largely on genitalic characters in dried specimens; these species would correspond to Needham's *bilineata* form *bilineata* (fig. 61) (*err. det.*) and *bilineata* form *munda* Eaton (fig. 64), also an obvious misidentification, as the type male of *munda* at Cambridge, Mass. shows a hook-like penis, much as in *limbata* Guer. (vide Ulmer's figure and Needham's figure 63); Needham's fig. 65 as *bilineata* form *falcata* (subimago) should also be referred to *rigida* McDunnough. A study of more material of *atrocaudata* in fresh condition shows that, besides a remarkable constancy in the shape of the male genitalia (both in subimago and adult), there is also a very distinct abdominal pattern, best understood by a reference to the accompanying figure (fig. 2).

At Sparrow Lake, as I mentioned above, I was privileged to witness the emergence and flight of vast numbers of Hexagenias; the tree-trunks and buildings in the vicinity of the lake were covered with subimagos and a few days later swarms of adults filled the air toward sundown. I at first was under the impression that only a single species was represented but, after a careful study of the unlimited material at my disposal, came to the conclusion that at least three species could be distinguished by the abdominal maculation alone, and it only required a little practice to be able to pick these three species out quite readily, both in the subimagos and in the two sexes of the adult.

In one species which for the present I call "Species No. 1" the abdomen was a deep black-brown with narrow subdorsal pale dashes and the posterior margin of each segment similarly colored (vide fig. 5); the setae were largely brown, slightly ringed with yellowish on the anterior portion of each segment; the eyes of the ♂ were deep-brown above and decidedly larger than in the other two species and the forelegs were normally longer. There was a very decided brown border on the hind wing in both sexes.

"Species No. 2" was noticeable for the bright yellow character of the dorsal maculation which consisted of two elongate triangular subdorsal spots, based on the anterior margin of each segment, the posterior margin being usually narrowly yellowish (vide fig. 3); the setae were largely yellowish with narrow brown rings at the joints; the eyes of the ♂ were deep olive-brown above and smaller than in "Species 1." The brown border of the hind wings was narrowed and less noticeable than in the previous species. The females and even the subimagos showed the same bright, contrasted type of abdominal maculation.

"Species No. 3" possessed the same bright yellow character of maculation as "Species 2" but differed decidedly in the more irregular nature of the spots and the fact that they were not based on the anterior margin of the segment but entirely surrounded by the dark brown ground-color (vide fig. 4); yellow triangles, situated in the postero-lateral corners, were better developed than in "Species 2" especially in the females (not seen in the figure), and the posterior borders of the segments, in the males at least, were scarcely tinged with yellowish;

the setae were irregularly and broadly banded with brown and yellow, the eyes of the ♂ were of similar size to those of "Species 2" but with a slight greenish tinge and the dark border of the hind wings was lacking.

On closer examination it was found that the two latter species could further be separated by the structure of the ♂ genitalia; in "Species 2" the penis was rod-like whilst in "Species 3" it was hook-like; no intergradations were observed and even in the subimagos the two types were easily visible, although considerably smaller and less developed.

On returning to Ottawa "Species 2" was readily determined as *rigida* McD.; a few of the ♀ Paratypes of this species, examined in the light of my more accurate knowledge of this sex, proved to belong to the species which I called *limbata* at the time of description; the color of the longitudinal veins in the primaries which I mentioned then as diagnostic can hardly I think be considered of much value as a means of differentiation as it apparently varies according to the age of the specimen.

For Species 1 and 3 I could find no names available; the genitalia of both were of the *limbata* type, which eliminated *bilineata* Say from consideration: the abdominal maculation, however, forbade a reference of either species to *limbata*. As there were several of Walker's names in the synonymy of *limbata*, the identity of which had never been satisfactorily cleared up, I finally sent a considerable series of specimens to Mr. R. G. Blair of the British Museum, who kindly examined Walker's types in the light of my suggestions; as a result it was found that the name *viridescens* Wlk. based on a ♀ subimago from St. Martin's Falls, Albany River was applicable to Species No. 1; this name, therefore, must be reinstated as that of a good species.

As there appears to be no name available for Species 3 I propose the name *AFFILIATA*; the chief distinctive characters have already been given but in addition it might be mentioned that in the male sex on the ventral side of each abdominal segment, besides a medioventral brown line, there is a more or less semicircular brown patch, based on the posterior margin and occupying nearly the entire posterior half of the segment but *not attaining the anterior border*; on the rear segments the shape is roughly triangular rather than semicircular. These brown patches are only rarely present in the ♀ which generally merely show a broken medioventral dark line.

Holotype.—♂, Sparrow Lake, near Severn, Ont., June 16-21, (J. McDunnough); No. 2426 in the Canadian National Collection, Ottawa.

Allotype.—♀, same data.

Paratypes.—21 ♂, 8 ♀, same data.

Specimens of this species are also before me from the Ottawa region, Kingston and Algonquin Park, Ontario.

In conclusion it remains to discuss briefly one of our commonest Canadian species of *Hexagenia* to which I have formerly referred under the name *limbata* Guer. Typical *limbata* is evidently a pale yellow species with decided yellow abdominal maculation; it is doubtful if the typical form occurs in eastern Canada, its range being southern and western. I have examined a few specimens from central Illinois where it occurs along with *venusta* Eaton and have a long

series before me of almost typical specimens from various localities in southern British Columbia. Our eastern form, common throughout the Great Lakes and St. Lawrence regions and extending into Manitoba, lacks the clearly-cut yellow maculation, this being suffused to a greater or less degree in the males with pale ruddy-brown; even in the females this suffusion is present in a more moderate degree. Generally speaking the males have a dark border to the hind wings which, together with the suffused type of maculation, distinguishes the species from *affiliata*. As however this dark border does not appear to be entirely constant a further means of separation in the male sex is found in the ventral abdominal maculation; the semicircular brown patches of *affiliata* have become triangular patches with the apex of the triangle attaining the anterior margin of segment in the median line, thus leaving only an antero-lateral patch of the pale ground-color visible; at times almost the whole ventral surface is suffused with brown. Suffused males, especially when dried, are apt to be confused with *viridescens* Wlk. which has the same ventral abdominal markings and hook-like type of penis; the latter species, is however, larger and the diameter of the eye considerably greater.

I am still in doubt as to whether the species under discussion is a good species or merely a northern form of *limbata*; in any case the name *occulta* Wlk., with *angulata* Wlk. as a synonym, will apply to this form, according to Mr. R. G. Blair's comparisons and notes on Walker's types. Possibly when I have had opportunity to study the species during one of its swarming periods I may be able to discover points of specific distinction; for the present I shall refer to the form as *limbata* var. *occulta* Wlk.

NOTES ON THE HIBERNATION OF THE SPRUCE BARK-BEETLE. *IPS PERTURBATUS* EICHH. IN NORTHERN ONTARIO.*

BY E. B. WATSON,
Ottawa, Ont.

The location selected for hibernation by this bark-beetle has long been a mystery and it was believed at first that, in common with other members of the *Scolytidae*, these beetles did not depart from the usual custom of hibernating in their tunnels in the bark where they had matured from the egg.

In the Algoma District of Ontario, *Ips perturbatus* invariably passes the winter as a young adult beetle, the parent beetles dying in the summer after completing their tunnels. A partial emergence of beetles was noted late in the fall and it was assumed that these beetles were about to enter living or freshly-killed spruce preparatory to the excavation of egg-tunnels in the following spring. A close examination of windfall spruce and trees killed by *Dendroctonus piceaperda* earlier in the season failed to reveal any signs of *Ips perturbatus* and the species was not to be found at all until the following May when a few individuals were noted on the wing. Towards the end of the month, *Ips* was to be seen in numbers entering windfalls and the tops of spruce killed by *Dendroctonus* the previous year.

It has since been ascertained that the young adults of *Ips perturbatus* leave their tunnels in September and October and hibernate in the ground, emerg-

*—Contribution from Division of Forest Insects, Entomological Branch, Dept. Agriculture, Ottawa.

ing therefrom the following May.

The beetles go down to a depth of two or three inches and exhibit a decided preference for decayed wood but are also to be found abundantly in dead leaves, moss, under the decaying bark of windfalls and in similar places. More than 90% of the brood abandon their tunnels in the fall to enter the ground; only occasional specimens are to be found under the bark of the brood-tree.

The exact data in regard to the exodus from the tunnels in the fall months is as yet unknown; it has been proved that the beetles will crawl down the trunk of a tree lodged at an angle of 45° from the ground. Beetles were found in the moss and ground litter at the base of this tree; the insects must have crawled down the trunk from their tunnels in the top of the tree as no tunnels of this species were evident in the basal twenty feet of the trunk. There is also substantial evidence that the insects drop straight down to the ground on emerging from the bark; there is no evidence to show that the beetles take to the wing on emerging.

Since the emergence takes place comparatively late in the fall, the weather conditions at that time are not conducive to flight and it is interesting to note that fully matured beetles removed from the bark and placed in the sun in August and September made no attempt to fly but invariably sought shelter, though the weather conditions at the time were ideal for flight; this aversion to flight in late summer has been observed when the shade temperature has been over 80° F.

Emergence from the ground takes place towards the end of May, weather conditions being favorable; the beetles are then to be seen in swarms entering wind-fall spruce and the tops of trees killed by *Dendroctonus* the previous season.

A somewhat similar condition has been observed in the case of an allied species, *Ips pini* Say, though a larger percentage of beetles remain under the bark during the winter months. It was estimated that 60% of the brood of this species abandoned their tunnels in the autumn months to hibernate in the ground beneath the pine logs in which they had been reared. In Northern Ontario the emergence and flight of these two species of *Ips* occurs almost simultaneously.

OBITUARY

Wm. Lochhead, emeritus professor of entomology and zoology in Macdonald College, died at his home in Ste. Anne de Bellevue, Que., on March 26, 1927, in his 63rd year. In September, 1925, Professor Lochhead had retired from his former position of Professor of Entomology and Zoology owing to a serious heart affection which eventually caused his death.

For more than thirty years Professor Lochhead was one of our foremost leaders and teachers in Biology. He was educated at Listowel High School, McGill University (B. A., 1885), and Cornell University, Ithaca, N. Y., (B. Sc., 1895). During the years from 1886 to 1898 he was science master successively at the High Schools of Perth, Galt, Napanee and London, and in 1898 he joined the staff of the Ontario Agricultural College as Professor of Biology. He remained in this position until 1905 when he joined Dr. J. W. Robertson as Professor of Biology on the staff of Macdonald College, then being founded. The department of biology was divided in 1920 and Professor Lochhead became Professor of Entomology and Zoology. He held this position until September, 1925, when he retired from active work.

Professor Lochhead conducted important investigations on the biology and control of a series of destructive insects, including the Pea Weevil, the Hessian Fly, the San Jose Scale, and other scale insects of Ontario. He was the author of many articles and pamphlets dealing with the habits and control of insect pests and with the control of weeds and fungous diseases of plants. He was the author of a text book on Economic Entomology, which is now used as a class book in many Canadian and American College laboratories, and of a treatise on heredity and genetics.

The Quebec Society for the Protection of Plants was organized by Professor Lochhead in 1908, and he continued in the office of President until failing health compelled him to retire from active work. He was editor for many years, of the monthly Journal of Agriculture and Horticulture published by the Quebec Department of Agriculture. His efforts in connection with this Society and Journal have been of very great service to agriculture in Quebec province.

Professor Lochhead was an honored member of many scientific societies including the American Association of Economic Entomologists, the American Entomological Society, the American Nature Study Society, of which he was vice-president in 1910, the Ontario Entomological Society, president in 1902-4, and the Ottawa Field Naturalists' Club; he was a Fellow of the American Association for the Advancement of Science, and of the Canadian Society of Technical Agriculturists.

His contributions to our scientific knowledge, his long and splendid service as a teacher, his kindness of heart and nobility of character have given him a very high place in the esteem and affection of his fellow workers in Biology in this country. As of his distinguished confrere and intimate friend, the late Dr. Jas. Fletcher, so it may be said of Professor Wm. Lochhead, "He was one of the fathers of entomological work in this country and a 'friend' of all who knew him."

Recently an excellent portrait of Professor Lochhead, painted by G. Horne Russell, P.R.C.A., was placed in Macdonald College library by his old students and colleagues.

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